

II

SURVIVAL OF KNEE ENDOPROSTHESES FOR CHRONIC RHEUMATOID
AND RELATED ARTHRITIDES

by

Kaj Knutson, Björn Tjörnstrand & Lars Lidgren

From the University Department of Orthopaedics in Lund, Sweden

Abstract

During a fifteen year period 498 primary knee arthroplasties for chronic rheumatoid and related arthritides were performed in Lund. Ninety arthroplasties where prosthetic components were added, removed or replaced were registered as failures. Eighty-one revisions were exchange arthroplasties, eight attempted arthrodeses and one an above-the-knee amputation. Survival rates were calculated for the remaining arthroplasties using a life table technique. The cumulative five year survival rate was 76 per cent for tibial hemiprotheses, 78 per cent for unicompartment prostheses, 100 per cent for tricompartment prostheses, 87 per cent for stabilized prostheses and 84 per cent for hinged prostheses. Continuous deterioration was seen for the tibial hemiprotheses. The improved surgical technique, with guide instruments and release procedures for better alignment and stability, and to some extent the improved prosthetic design may explain the good early results with tricompartment prostheses.

Introduction

Most reports on knee replacements contain information on technical and operative experience with a short clinical follow-up. Only a few reports cover an observation time exceeding five years (Hamilton 1982, Marmor 1982, Insall et al. 1983). We are still waiting for confident data on the long-term results for many knee replacements. Dobbs (1980) advocated the survivorship method of comparing long-term results for various endoprotheses and observation times and this method has been applied in three reports on knee arthroplasties; Tew and Waugh (1982) who reported 365 knee arthroplasties with three types of replacement for osteoarthrosis and chronic arthritis with an annually increasing risk of revision and a cumulative five year survival rate of 78 per cent; Grimer et al. (1984) who reported a cumulative five year survival rate of 85 per cent in 103 Stanmore hinge replacements used for

the same indications; and Lettin et al. (1984) who reported 86 per cent in 210 of the same replacement.

Our experience with knee replacement extends over more than fifteen years. This is a report on the long-term results of five different types of knee endoprotheses used as primary replacements in chronic rheumatoid and related arthritides analyzed with the survivorship method.

Patients and methods

During the 15-year period 1969 through 1983, 498 primary knee arthroplasties were performed at the University Department of Orthopaedics in Lund, Sweden in patients with chronic rheumatoid and related arthritides. The vast majority had classical rheumatoid arthritis. The exceptions were mainly juvenile chronic arthritis, psoriatic arthritis and Bechterew's disease. The five types of endoprotheses used and the mean age of the patients at operation are listed in Table 1. The total annual number of primary arthroplasties and the yearly distribution between the different types of replacement are illustrated in Fig 1.

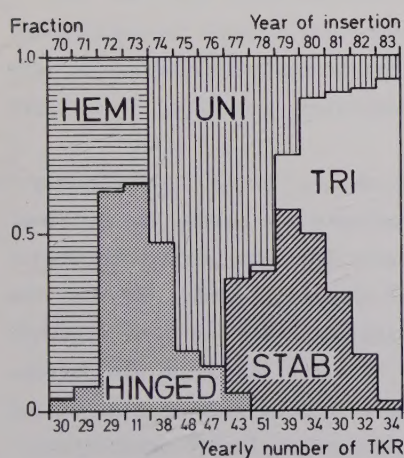


Fig 1. The yearly relative distribution during 1970 - 1983 of five types of primary knee * arthroplasty (495 knees) used in Lund for chronic arthritis and the annual total number of replacements.

* (Three patients included in the material but not in the diagram were operated before 1970).

Table 1. Type of knee replacement and age of patients in 498 primary arthroplasties for chronic rheumatoid and related arthritides

Type of knee Replacement	No of, replacements			Age	
	inserted, at 5 yrs, at 10 yrs			mean	range
Tibial hemiprosthesis (McIntosh)	72	49	31	53	25-74
Unicompartment pr. (Marmor, Marmor + St Georg Schlitten)	181	106	-	60	23-79
Tricompartment pr. (Total Condylar, Kinematic, PCA)	92	1	-	59	20-78
Stabilized prosthesis (Attenborough)	89	24	-	56	18-78
Hinged prosthesis (Guepar, Shier)	64	43	10	64	29-77

There were 380 replacements in female patients and 118 in male patients. The patients were controlled annually. Ninety-six patients died during follow-up.

The original procedure of the Guepar, Shier, Attenborough, tricompartment and McIntosh arthroplasty was used. The original Marmor procedure was abandoned early for the onlay technique which was performed using a tibial resection guide. During the 1980's the St Georg Schlitten tibial component was used together with the Marmor femoral component. Patellar resection was performed instead of prosthetic replacement in most cases. All except the McIntosh arthroplasties were given prophylactic antibiotics.

In this report the survivorship method as described by Dobbs (1980) was used. Success was defined as the endoprosthesis remaining in situ at the end of the follow-up regardless of complications and clinical scoring. Consequently, failure was scored for arthroplasties where prosthetic components had been added, removed or replaced. In the final review the status of each arthroplasty by December 31, 1983, was recorded. The length of the follow-up was determined for each patient, either to the date of the final review, the death of the patient or the date of the revision or arthrodesis. Survivorship tables were then constructed using a 12-month interval. For each interval after the operation the following was recorded: The total number of surviving arthroplasties entering the interval; the number of successes and failures in patients who had reached the end of their follow-up during the interval; the number of patients at risk (of being a failure) calculated as the total number of survivors entering the interval reduced by half the number of successes during the same interval; and the yearly probability of survival calculated by dividing the number at risk reduced by the number of failures with the number at risk. The number of successes and failures were subtracted from the total number of survivors to give the number of survivors to enter the next interval. The cumulative probability of survival was obtained by successive multiplication of the yearly values.

The survival distribution of tricompartment replacements was tested against that of the remaining replacements for the initial six years using the Mantel and Haenszel's Chi-Square Test (Lee 1980).

Table 2. Type of revision in ninety failed primary knee arthroplasties

Type of	Revised to						
Prosthesis	Hemi.	Uni.	Tri.	Stab.	Hinge.	Arthrod.	Amput.
Tibial hemipr.	3	10	3	6	5	1	-
Unicompartment	-	10	6	18	2	5	-
Tricompartment	-	-	-	-	-	-	-
Stabilized	-	-	1	6	-	1	-
Hinge	-	-	-	2	9	1	1

Results

Failure was recorded in 28 of the 72 McIntosh hemiarthroplasties, 41 of the 181 Marmor arthroplasties, none of the 92 tricompartment arthroplasties, eight of the 89 Attenborough stabilized arthroplasties and 13 of the 64 hinge arthroplasties (Table 2). The cumulative survival rates for the five types of primary knee arthroplasty are graphically presented in Fig 2. The survival distribution during the initial six years of tricompartment arthroplasties was significantly different from that of the remaining arthroplasties (Chi-Square = 5,80, $P < 0.05$). The types of revision performed in the ninety failures are listed in Table 2. There were eight attempted arthrodeses (1.6 per cent) and the amputation rate was 0.2 per cent.

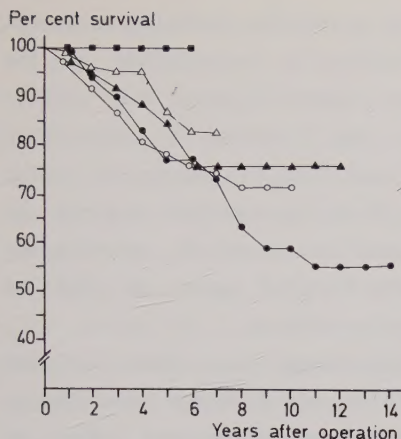


Fig 2. The cumulative survival rates of five types of primary knee arthroplasty used in Lund for chronic arthritis.

Tibial hemiprosthesis = ● ,
 unicompartament pr. = ○ ,
 tricompartment pr. = □ ,
 stabilized pr. = ▲ , and
 hinged pr. = ▲ .

Discussion

The importance of using a scoring system, allowing comparisons, in the evaluation of prosthetic surgery has been emphasized before (Andersson 1972, Jonsson 1981). The survivalship method of analysis gives an early warning of poor designs as well as a means of comparing results. The cumulative survival rates (Fig. 2) indicate that the change of prosthetic design at our department has, by and large, been favourable and our cumulative survival rates correspond well with those given by others reporting similar designs (Tew and Waugh 1982, Grimer et al. 1984, Lettin et al. 1984).

The comparison of survival rates for various endoprotheses must, however, be made with some caution. The survival rate depends on many factors, for instance, the degree of knee destruction, prosthetic design, instrumentation, surgical skill, operative asepsis and the use of antibiotic prophylaxis. These factors have not been constant during the period studied and some selections of patients were made although one type of endoprosthesis at a time was preferred regardless of the knee condition.

The survival rate also depends on whether revision is instituted or not. This might be influenced by the attitude of the surgeon and the patient and by the possibilities at hand (Table 2). Compartmental prostheses are usually easier to replace than hinged prostheses and mechanical complications easier to revise than infections. If a patient and the surgeon prefer to treat an infected arthroplasty with antibiotics instead of revising or fusing the knee, this arthroplasty will not appear as a failure in this study because of the definitions used.

Many of the arthroplasties in this study have been included in earlier short-term clinical follow-ups from our department. Only twenty-three of 67 McIntosh arthroplasties were rated as satisfactory after three years (Andersen, 1979). Femoral attrition, subsidence and translatory instability were the main cause of poor results.

After two years 76 of 109 Marmor arthroplasties were clinically satisfactory (Andersen, 1979). The main problems were loosening, especially of the thin (6 mm) tibial component no longer used (Marmor 1979, Knutson et al. 1981), translatory instability, patellar impingement, and failure due to progressive destruction of the remaining compartment in demi-arthroplasties.

Thirty of 64 primary and secondary hinge arthroplasties were rated as clinically satisfactory after three years (Andersen, 1979). The major problems were infection, patellar dislocation and mechanical loosening.

Twenty-nine of 74 primary and secondary Attenborough arthroplasties were clinical or potential radiographic failures, mainly loosening or subsidence (Boegård et al. 1984). These problems were strongly correlated to postoperative malalignment which remained a problem in spite of improved instrumentation.

Tricompartament prostheses have been the most frequently used since 1979. So far there has been no failures. The designs and instrumentation are being continuously refined with increased contact area, metal backing of the tibial component, soft tissue release procedures for better alignment and stability and, though still at an experimental stage, cementless fixation. Favourable results were also reported by Laskin (1981) with only four

revised failures in 117 Total Condylar Replacements in RA with a 2-4-year follow-up.

With the exception of the hemi-endoprotheses, there was a higher annual survival rate after six years in designs with longer observation time. This was also reported by Lettin and associates (1984) but not by Tew and Waugh (1982). In hip replacements this pattern is not seen, instead the annual success rate is slowly declining (Dobbs 1980). It is possible that the success rate during the first five to six years mainly reflects surgical skill and technique, joint stability and alignment, operative asepsis and selection of patients, whereas the later survival rate more closely reflects the soundness of the prosthetic design. New prosthetic designs should therefore not be generally accepted without at least a five year follow-up and a survival rate comparable to or exceeding that of earlier designs. A better surgical technique compared with earlier years may explain our initially good results with tricompartment prostheses and only extended observation time will reveal the durability of these designs.

At our department today only extremely unstable knees are treated with a stabilized prosthesis (Fig 1). The unicompartment replacement is reserved for cases of burnt out rheumatoid arthritis with localized derangement in a fairly stable knee. A tricompartment prosthesis seems to be the rational choice for the majority of destroyed knees in patients with chronic rheumatoid or related arthritides.

REFERENCES

- Andersen, J.L. (1979) Knee arthroplasty in rheumatoid arthritis. Acta Orthop. Scand. Suppl. 180.
- Andersson, G. (1972) Hip assessment: A comparison of nine different methods. J. Bone Joint Surg. 54-B, 621-625.
- Boegård, T., Brattström, H. & Lidgren, L. (1984) Seventy-four Attenborough knee replacements for rheumatoid arthritis. A clinical and radiographic study. Acta Orthop. Scand. 55, 166-171.
- Dobbs, H.S. (1980) Survivorship of total hip replacements. J. Bone Joint Surg. 62-B, 168-173.
- Grimer, R.J., Karpinski, M.R.K. & Edwards, A.N. (1984) The long-term results of Stanmore total knee replacements. J. Bone Joint Surg. 66-B, 55-62.
- Hamilton, L.R. (1982) UCI total knee replacement. J. Bone Joint Surg. 64-A, 740-744.
- Insall, J.N., Hood, R.W., Flawn, L.B. & Sullivan, D.J. (1983) The total condylar knee prosthesis in gonarthrosis: A five to nine year follow-up of the first one hundred consecutive replacements. J. Bone Joint Surg. 65-A, 619-128.
- Jonsson, G.T. (1981) Compartmental arthroplasty for gonarthrosis. Acta Orthop. Scand. Suppl. 193.
- Knutson, K., Jonsson, G., Andersen, J.L., Larusdottir, H. & Lidgren, L. (1981) Deformation and loosening of the tibial component in knee arthroplasty with unicompartamental endoprostheses. Acta Orthop. Scand. 52, 667-673.

- Laskin, R.S. (1981) Total condylar knee replacement in rheumatoid arthritis. A review of one hundred and seventeen knees. J. Bone Joint Surg. 63-A, 29-35.
- Lee, E.T. (1980) Statistical methods for survival data analysis. Pp. 136-139. Lifetime Learning Publications, Belmont, California.
- Lettin, A.W.F., Kavanagh, T.G., Craig, D. & Scales, J.T. (1984) Assessment of the survival and the clinical results of Stanmore total knee replacements. J. Bone Joint Surg. 66-B, 355-361.
- Marmor, L. (1982) The Marmor knee replacement. Orthop. Clin. North Am. 13, 55-64.
- Tew, M. & Waugh, W. (1982) Estimating the survival time of knee replacements. J. Bone Joint Surg. 64-B, 579-582.

